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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/532,084	04/21/2005	Takashi Yasumura	050251	6480
23850	7590	12/19/2006	EXAMINER	
ARMSTRONG, KRATZ, QUINTOS, HANSON & BROOKS, LLP			WU, IVES J	
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SUITE 1000			1724	
WASHINGTON, DC 20006				
SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE		DELIVERY MODE	
3 MONTHS	12/19/2006		PAPER	

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/532,084	YASUMURA ET AL.	
Examiner	Art Unit		
Ives Wu	1724		

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

## Disposition of Claims

4)  Claim(s) 1-6 and 8-20 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.

5)  Claim(s) \_\_\_\_\_ is/are allowed.

6)  Claim(s) 1-6,8-20 is/are rejected.

7)  Claim(s) \_\_\_\_\_ is/are objected to.

8)  Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

9)  The specification is objected to by the Examiner.

10)  The drawing(s) filed on \_\_\_\_\_ is/are: a)  accepted or b)  objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)  The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)  Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a)  All b)  Some \* c)  None of:  
1.  Certified copies of the priority documents have been received.  
2.  Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3.  Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1)  Notice of References Cited (PTO-892) 4)  Interview Summary (PTO-413)  
2)  Notice of Draftsperson's Patent Drawing Review (PTO-948) Paper No(s)/Mail Date. \_\_\_\_\_  
3)  Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_ 5)  Notice of Informal Patent Application  
6)  Other: \_\_\_\_\_

## DETAILED ACTION

(1). Applicants' Remarks, Amendments and Request-for-Continued Examination (RCEX) filed on October 3, 2006 have been received.

Claims 1 and 12 are amended. Claim 7 was cancelled previously.

The objection of claim 10 in prior Office Action dated July 3, 2006 is withdrawn in response to Remarks filed on October 3, 2006.

An Office Action in response to the RCEX is presented in the following.

### *Claim Rejections - 35 USC § 103*

(2). The text of those Section Title 35 U. S. Code not included in this Office Action can be found in the prior Office Action dated February 28, 2006.

(3). **Claims 1~4 and 8~20** are rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al (US20020055030A1) in view of Hendershot et al (US006441060B1), Hefner Jr, et al (US004618658) and Nagasawa et al (US004205018).

(4). Okumura et al disclose a separator for solid polymer-type fuel cell produced by molding the resin composition which comprises an electroconductive agent and a radical-polymerizable thermosetting resin system by a resin molding method (Abstract, line 1-5).

As the electroconductive agent (or electrically conductive agent), a variety of components such as carbon powders, graphite powder, electrocarbon black powder These electroconductive agents can be used singly or in combination ([0015], line 1-9).

The weight ratio of the electroconductive agent to the radical-polymerizable thermosetting resin system is about 55/45 to 95/5 ([0064], line 1-3).

It is sufficient that the radical-polymerizable thermosetting resin system comprises at least a radical-polymerizable resin, and the radical-polymerizable thermosetting resin system may comprise a radical-polymerizable thermosetting resin system or an oligomer having a  $\alpha$ ,  $\beta$ -ethylenically unsaturated bond (a polymerizable unsaturated bond). For example, vinyl ester-series resins, unsaturated polyester-series resins, urethane (meth)acrylates, polyester

(meth)acrylates and the like. These radical-polymerizable resins can be used singly or in combination ([0018], line 1-11).

(a). Vinyl Ester-series Resin (e.g., epoxy (meth)acrylate) includes, for example, a reaction product of a compound having one or more epoxy groups in a molecule with an ethylenically unsaturated compound having a carboxyl group such as an unsaturated monobasic acid ([0019] - [0020]). As epoxy resin, there may be mentioned glycidyl ether-type epoxy resins, alicyclic epoxy resins ([0022], line 1-3). As the glycidyl ether-type epoxy resin, there may be mentioned bisphenol-type epoxy resin such as bisphenol - type epoxy resin, novolak-type epoxy resins, aliphatic epoxy resin ([0023], line 1-7). As to the ethylenically unsaturated compound having a carboxyl group such as an unsaturated monobasic acid, (meth)acrylic acid, crotonic acid ([0032], line 1-5).

(b). Unsaturated polyester-series Resin ([0038]).

(c). Urethane (meth)acrylate, a reaction product of a polyurethane oligomer having an isocyanate group at its terminal position with the above hydroxyl C<sub>2-6</sub> alkyl (meth)acrylate can be employed as the urethane (meth)acrylate ([0046] – [0047]). A conventional polyurethane oligomer obtainable with the use of excess amount of diisocyanate component relative to diol component can be used as the polyurethane oligomer. The polyurethane oligomer includes, for example, a reaction product of a diisocyanate component (e.g., an aromatic diisocyanate such as tolylenediisocyanate and diphenylmethanediisocyanate, an araliphatic diisocyanate, an alicyclic diisocyanate, and aliphatic diisocyanate with a diol component (e.g., C<sub>2-12</sub> alkylene glycols, polyether diols such as polyoxy C<sub>2-4</sub> alkylene glycols, polyester diols, polycarbonate diols).

As the radical-polymerizable diluent, there may be mentioned unsaturated carboxylic acids such as (meth)acrylic acid, vinyl pyrrolidone; aromatic vinyl compounds such as styrene ([0060], line 1-3, line 11-12). The wt ratio of the radical-polymerizable resin to the radical-polymerizable thermosetting diluent can be usually selected within the range of about 100/0 to 20/80 ([0062], line 1-3).

As to the curing agent, there may be mentioned organic peroxides, for example, aliphatic peroxides ([0074], line 1-2).

The patentee's invention also includes a separator for a solid polymer-type fuel cell formed with resin composition (e.g., carbon separate). The separator is excellent in gas-

imperviousness and durability. Moreover, the resin composition has excellent moldability. Therefore, the process for producing the separator by molding the resin composition by means of a resin molding method is included. Moreover, in the process, the resin composition may be kneaded with a pressure kneader and molded ([0012]). The kneading temperature is not particularly limited, and is about room temperature to about 100 °C., preferably about room temperature to 50 °C ([0084]).

Illustrated in Examples 1 and 2, the preparation for thermosetting compositions is demonstrated. In Examples 3 and 4, the kneading and molded plate is obtained ([0107]).

(5). As to epoxy (meth)acrylate being obtained by an addition of an epoxy resin having an aromatic cyclic structural unit and/or an aliphatic cyclic structural unit and a (meth)acrylic acid in **independent claim 1**, Okumura et al disclose reaction product of a compound having one or more epoxy groups in a molecule with an ethylenically unsaturated compound having a carboxyl group such as an unsaturated monobasic acid ([0020], line 6-10).

(6). As to the component (B) of urethane-modified epoxy (meth)acrylate obtained by reacting an epoxy (meth)acrylate with a polyisocyanate in a conductive resin composition in **independent claim 1**, Okumura et al **teach** Urethane (meth)acrylate, a reaction product of a polyurethane oligomer having an isocyanate group at its terminal position with hydroxyl C<sub>2-6</sub> alkyl (meth)acrylate can be employed as the urethane (meth)acrylate ([0047]). Okumura et al **do not teach** a urethane-modified epoxy (meth)acrylate resin.

However, Hendershot et al **teach** the foundry binder system comprising an epoxy resin and an acrylated organic polyisocyanate, a reactive unsaturated acrylic monomer, acrylic polymer, or mixtures thereof (Abstract, line 1-5). The acrylated organic polyisocyanate is prepared by reacting the organic polyisocyanate with a reactive unsaturated acrylic monomer or polymer a free hydroxyl or free carboxylic acid functional group (Col. 4, line 44-48). Typical acrylic polymers, which can be used as the reactive unsaturated polymer to prepare the acrylated organic polyisocyanates include epoxy acrylate reaction products, acrylate epoxy resins (Col. 4, line 61-67).

The advantage of using acrylated organic polyisocyanate (epoxy acrylated reaction products with organic polyisocyanate) as foundry is to improve the benchlife of foundry mixes made with the foundry binder (Col. 2, line 53-56), which produce cores and molds with adequate

tensile strengths for commercial use (Col. 2, line 57-58). Moreover, the use of urethanized epoxy resin acrylate is evidenced by Nagasawa et al (US004205018) and Hefner Jr. et al (US004618658) wherein Nagasawa et al cite that generally speaking, the urethanized epoxy resin acrylate or methacrylate exhibits better curability (i.e.. a shorter curing time) and solvent resistivity (Col. 3, line 8-11), and Hefner Jr. et al cite that these compositions illustrated in Example 1 and 2 are useful as intermediates to novel polymer modified vinyl esters and thermoset (cured) products.

Therefore, it would have been obvious at time the invention was made to replace the urethane-modified epoxy (meth)acrylate of Hendershot et al with the urethane (meth) acrylate resin in the composition of Okumura et al in order to obtain the advantage cited in the preceding paragraph.

As to the molar ratio of moles of hydroxyl group of epoxy(meth)acrylate to moles of isocyanate group of polyisocyanate being within the range of 1.0/(0.5 to 1.5) in **independent claim 1**, Okumura et al disclose the molar ratio of hydroxyl group to isocyanate group of the urethane oligomer is hydroxyl group/isocyanate group = about 0.7/1 to 1.2/1, preferably about 0.8/1 to 1.1/1, more preferably about 0.9/1 to 1/1 ([0049]).

As to epoxy (meth)acrylate having hydroxyl value from 100 to 300 in **independent claim 1**, in view of substantially identical epoxy (meth)acrylate disclosed by applicants and by Okumura et al, it is Examiner's position to believe that the epoxy (meth)acrylate of prior art would inherently possess the hydroxyl value from 100 to 300 as claimed. Since the PTO does not have proper means to conduct experiments, the burden is now shifted to applicants to prove otherwise. *In re Fitzgerald*, 205 USPQ 594 (CCPA 1980).

As to the component (C), a (meth)acrylate having average molecular weight of 500 to 10,000 which contains 20 to 80 wt% of an aromatic cyclic structural unit and/or an aliphatic cyclic structural unit and contains no active hydrogen atom in **independent claim 1**, Okumura et al disclose the urethane (meth)acrylate in paragraph (3) which includes examples of the molecule having a number average molecule weight of 500 to 10,000, also 20 to 80 wt% of an aromatic cyclic structural unit and/or an aliphatic cyclic structural unit and no active hydrogen atom.

As to the conductive filler (A), an epoxy (meth)acrylate obtained by the addition reaction of an epoxy resin having aromatic cyclic structural unit and/or an aliphatic cyclic structural unit and a (meth)acrylic acid, a polyisocyanate, and methacrylate (C) having a number average molecular weight of 500 to 10,000 containing 20 to 80 wt% of an aromatic cyclic structural unit and/or an aliphatic cyclic structural unit and contains no active hydrogen, and an ethylenically unsaturated monomer (D) in 1<sup>st</sup> step in **independent claim 12**, the disclosure of Okumura et al, Hendershot et al is incorporated herein by reference, the most subject matters as claimed have been recited in applicant's claims 1, and have been discussed therein.

As to the epoxy (meth)acrylate having a hydroxyl value in the range of 100 to 300 and molar ratio of moles of hydroxyl group of the epoxy(meth)acrylate to moles of isocyanate group of the polyisocyanate to be within range of 1.0/(0.5 to 1.5) in independent claim 12, the disclosure of Okumura et al, Hendershot et al is incorporated herein by reference, the most subject matters as claimed have been recited in applicant's claim 1 and have been discussed therein.

As to the step of kneading in **independent claim 12**, Okumura et al disclose, incidentally, when the resin composition is kneaded with the use of a conventional kneader, a powder or coarse particulate compound is sometimes formed ([0082], line 1-6). Dearing is disclosed in Example 1, which would remove active hydrogen atom during the kneading.

As to 2<sup>nd</sup> step of heating the kneaded mixture to temperature 80 °C thereby causing chain elongation in **independent claim 12**, Okumura et al disclose the kneading temperature is not particularly limited, and is about room temperature to about 100 °C, preferably about room temperature to about 80 °C ([0084]). Shown in Example 1, the 2<sup>nd</sup> heating step is disclosed at temperature 150 °C ([0091]). In a sense, the curing will cause chain elongation.

- (6). The same rationale of rejection for **claims 2-4, 8-11,13-20** has been recited in the prior Office Action dated July 3, 2006.
- (7). **Claim 6** is rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al (US20020055030A1) in view of Hendershot et al (US006441060B1), Hefner Jr, et al (US004618658) and Nagasawa et al (US004205018), and further in view of Takeshi et al (JP 2000-351843) recited in prior Office Action dated February 28, 2006.

(8). **Claim 5** is rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al (US20020055030A1) in view of Hendershot et al (US006441060B1), Hefner Jr, et al (US004618658) and Nagasawa et al (US004205018), and further in view of Toshiro et al (JP 03-199230) for the same rationale recited in the prior Office Action dated February 28, 2006.

### ***Response to Arguments***

Applicant's arguments filed on October 3, 2006 have been fully considered but they are not persuasive.

(8). Applicants' point out that the prior art references Okumura et al (US20020055030A1), Hendershot et al (US006441060B1), Nagasawa et al (US004205018) do not disclose that a hydroxyl value of epoxy(meth)acrylate is controlled in order to obtain a molded article having improved durability due to increased corrosion resistance (page 8, Remarks). Also an increase in mechanical strength can be achieved by decreasing water absorption or hydrolysis through reaction of the hydroxyl group of the epoxy (meth)acrylate with a polyisocyanate resulting in less hydroxyl groups than epoxy(meth)acrylate (page 10, Remarks).

In reviewing the teaching of Hendershot et al (US006441060B1), it recites: the acrylate organic polyisocyanate (reaction product of epoxy acrylate and polyisocyanate) would **improve the benchlife** of molded article. The foundry mixes produce cores and molds with adequate tensile strength (Col. 2, line 54-58). A measure of usefulness of foundry mix and the acceptability of the molds and cores prepared is the **tensile strength** of the molds and cores (Col. 1, line 52-58). Since the prior art reference Hendershot et al (US006441060B1) already disclose the improvement of tensile strength and longer benchlife (durability) of articles, therefore, the effects of controlling hydroxyl value is inherited. Nagasawa et al (US006441060B1) also cite that generally speaking, the urethanized epoxy resin acrylate or methacrylate exhibits better curability (i.e.. a shorter curing time) and solvent resistivity (Col. 3, line 8-11). Therefore, claims 1-6 and 8-20 are pending.

### ***Conclusion***

Art Unit: 1724

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ives Wu whose telephone number is 571-272-4245. The examiner can normally be reached on 8:00 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on 571-272-1166. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Examiner: Ives Wu

Art Unit: 1724

Date: December 12, 2006

DUANE SMITH  
PRIMARY EXAMINER

*D-SW*  
12-12-06